Financial Literacy, Financial Markets Index, and Investors' Biased Responses

THESIS

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Abstract

Using earnings data from Q1 2012 to Q4 2015 for 300 stocks in 15 countries, this study aims to investigate relations between financial literacy, financial markets index, and investors' biased responses to earnings news.

Financial literacy refers to an individual's abilities and skills to manage financial problems and make informed decisions that benefit his or her personal financial well-being, including retirement, investing, and loans, etc. (Lusardi & Mitchell, 2014). Financial markets index reflects how developed a financial market is, including its depth, access, and efficiency (Svirydzenka, 2016). Stock prices' biased responses happen when prices fail to reflect all available information. A variety of studies have been done to investigate why stock prices underreact or overreact to earnings news. There is, however, few or no study trying to link financial education and financial markets development to stock price's biased responses. Therefore, objectives of this study are to better understand whether a higher level of financial education would ease investors' sensitivity to news, and if a more developed financial market would lessen underreactions and overreactions of stock prices to earnings announcements. The methodology of this study is regression analysis. Major findings are that the level of financial literacy does not have a significant influence on the magnitude of earnings surprise, and that financial markets index is negatively correlated to investors' biased responses to earnings surprise. The more developed a market is, the better market movements incorporate anticipated information.

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Introduction

Recently, stock markets around the world experienced rapid growth and more people started investing in stock markets. The number of publicly traded companies grew from 34,961 in 1995 to 43,593 in 2015. Total market capitalization of listed companies in the world also increased from $17.5 trillion to $61.78 trillion over the same period (The World Bank, 2017). Meanwhile, as indicated by GDP per capita, level of income continued to soar. For example, in the United States, GDP per capita increased from $28,782 to $56,115 in 2015, which is twice as it was in 1995. In China, GDP per capita grew more rapidly from $609 to $8,027 over the past 20 years (The World Bank, 2017). With the development of economy and technology, more and more people have their own saving accounts, credit cards, and home mortgages, etc. Additionally, financial products became more complicated and easy for investors to access. Online stock trading platforms such as TD Ameritrade and OptionsHouse allow investors to trade stocks by one click. How will their participations affect stock prices behaviors?

Prior research points out that investors and analysts underreact to earnings news and that stock returns drift in the same direction as the immediate price reaction (Bernard & Thomas, 1989). Post-earnings announcement drift has been studied for many years. One potential explanation for this phenomenon is that analysts' expectations for companies' earnings are based on a naïve earnings model, which states that "expected earnings are simply earnings for the corresponding quarter from the previous year". Stock prices and

market investors fail to respond to signal that current earnings changes have on future earnings changes (Bernard, 1992). This is a puzzling phenomenon against the Efficient Market Hypothesis.

Nowadays, as an increasing number of investors decide to invest in stock markets, are they able to make informed decisions about their investments? Will investors' financial knowledge affect stock prices reactions to earnings news? Are financial markets efficient enough to respond to complicated investors' behaviors? To assess these questions, this study focuses on financial literacy and financial markets index and uses regression analysis to examine market efficiency. The results shall shed light on the enhancement of efficiency for policymakers, educators, and investors.

This study is organized as follows. It starts with literature review, which offers basic understandings about financial literacy and financial markets index, including measurements, past researches, and implications. The next section discusses methodology of this paper, such as objectives, hypotheses, data collections, and regression analyses. Based on the empirical study, this paper then turns to talk about its conclusions and limitations.

Literature Review

1. Financial Literacy

Financial literacy refers to an individual's abilities and skills to manage financial problems and make informed decisions that benefit his or her personal financial well-being, including retirement, investing, and loans, etc. (Lusardi & Mitchell, 2014). Over the past several years, an increasing number of researches were done to evaluate the importance of financial literacy and financial education.

In 2013, Jappelli and Padula suggest a multiperiod life cycle model and conclude that financial literacy and wealth are positively correlated, indicating that financial literacy is beneficial for the accumulation of wealth (Jappelli & Padula, 2013). More specifically, in the United States, individuals with higher financial literacy tend to save more and spend less, and are willingly to participate in the stock markets (Asia-Pacific Economic Cooperation, 2014). Similar correlation is also found in most countries (Lusardi & Mitchell, 2014). Investors who are financially educated tend to be more financially sophisticated and would exhibit similar behaviors that suggested by economists (Kimball & Shumway, 2006).

There are a few surveys trying to provide snapshots of financial literacy of adults on the national level. In 1998, Chen and Volpe design a 52-item questionnaire and survey 924 college students in the United States to examine their knowledge about personal finance. Chen and Volpe conclude that college students are not knowledgeable enough about

personal finance and are incompetent to make informed decisions. The level of financial literacy is affected by gender, major, age, and work experience (Volpe & Chen, 1998). Later in 2003, ANZ Banking Group in Australia conduct an in-depth study through 3,548 phone surveys and 202 in-person interviews to examine financial literacy levels of Australians. They explore financial literacy levels by measuring respondents' mathematical literacy, standard literacy, financial understanding, financial competence, and financial responsibility. Their main finding is that people with lower education, lower income, lower savings, who do not work, who are single, and whose age are between 18-24 years and over 70 years usually have lower financial literacy levels (Roy Morgan Research, 2003).

More recently, researchers start focusing on cross-country comparison of financial literacy levels. One of the most comprehensive studies is done by Klapper, Lusardi, and Oudheusden in 2015. Over 150,000 adults who age 15 and above are selected from 144 nations. In this study, the authors design four questions to assess a person's knowledge about risk diversification, inflation, numeracy, and compound interest, which are fundamentals of finance. Individual who could correctly answer three out of four questions is said to be financially literate. The financial literacy level of a country is approximated by the percentage of financially literate participants in that country. Levels of countries' financial literacy range from 13% in Yemen to 71% in Norway, and only one third of the participants are defined as financially literate worldwide. Among 144 countries, the wealthy with an easy access to financial services usually has higher levels of financial

literacy compared to the rest of the world. It is undisputed that financial illiteracy is widespread across the world even in developed economies such as the United States, the United Kingdom, and Hong Kong.

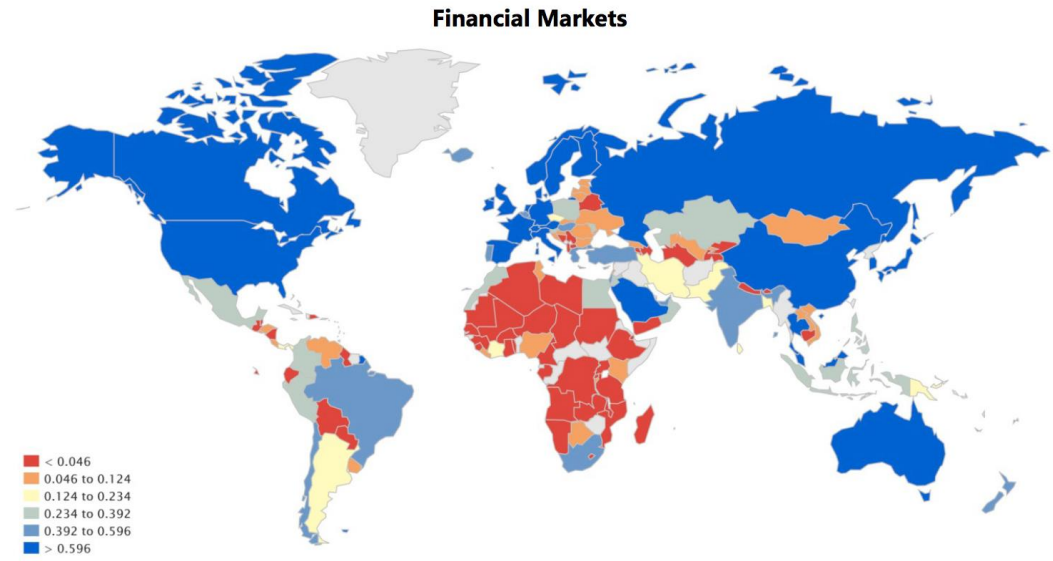
2. Financial Markets Index

Financial markets index reflects how developed a financial market is, including its depth, access, and efficiency (Svirydzenka, 2016). It is a relatively new concept introduced by Svirydzenka in 2016. Financial markets index is a comprehensive measurement of financial development, and it contains more information due to its broad coverage of key indicators, including stocks traded to GDP, stock market turnover ratio, and total number of issuers of debt, etc. To construct the index, Svirydzenka collects data from FinStats 2015, BIS debt securities database, and Dealogic corporate debt database for the past 33 years (Table 1). Putting all data together, Svirydzenka calculates relative rankings of countries' financial markets development. The result reveals that the largest markets may not necessarily be the most developed markets once we consider their accessibility and efficiency (Figure 1).

Table 1. Data Sources of Financial Markets Index

CATEGORY	INDICATOR	DATA SOURCE
Financial Markets		
Depth	Stock market capitalization to GDP	FinStats 2015
	Stocks traded to GDP	FinStats 2015
	International debt securities of government to GDP	BIS debt securities database
	Total debt securities of financial corporations to GDP	Dealogic corporate debt database
	Total debt securities of nonfinancial corporations to GDP	Dealogic corporate debt database
Access	Percent of market capitalization outside of top 10 largest companies	FinStats 2015
	Total number of issuers of debt (domestic and external, nonfinancial and financial corporations)	FinStats 2015
Efficiency	Stock market turnover ratio (stocks traded to capitalization)	FinStats 2015

Figure 1. Financial Markets Index across the Globe



Source: IMF staff estimates.

Methodology

This study mainly uses regression analysis to analyze correlations between financial literacy, financial markets index, and earnings surprise.

1. Objectives

Prior studies showed that financial literacy was positively correlated to wealth accumulation, retirement planning, and paying off home mortgage (Jappelli & Padula, 2013, Lusardi & Mitchell, 2014). More recently, it is linked to investors behaviors as well. Researchers suggest that investors with higher level of financial literacy are more likely to behave in a way that economists expect (Kimball & Shumway, 2006). For example, Abreu and Mendes conduct a survey on retail investors and find that those with higher financial literacy usually hold a greater number of assets in their portfolios, thus decreasing risks (2010). Other studies also attempt to investigate relations between financial literacy and investors' decision-making processes. However, few paper discusses impacts that financial literacy has on stock prices and on market efficiency.

As more and more people start trading stocks and purchasing financial products, are they competent to make informed investment decisions? Will their participations in stock markets irrationally affect stock prices? Would investors behave more rationally if they have enough knowledge about fundamentals of finance? To fill this gap, this study aims to

uncover correlations between financial literacy, financial markets index, and prices biased responses to earnings news.

2. Hypotheses

One possible explanation for stock prices underreactions and overreactions to earnings news is that market participants fail to respond fully and immediately to implications of current earnings news. Neoclassical model in economics claims that people make decisions that maximize their utility. It assumes that individuals have complete information and are capable of making rational decisions based on information they possess (Knoll, 2010). Recently, studies in behavioral finance started to link investor's rational behaviors to levels of financial literacy. This study investigates investors' behaviors in response to earnings news to assess roles of financial literacy and financial markets development in decision-making processes and investors' biased reactions. Two hypotheses are established.

(1) Attempt to link financial education and biased price responses

H_1: Investors in countries with higher levels of financial literacy will have less biased reactions to earnings news.

(2) Attempt to link development of financial markets and biased price responses

H_2: Investors in countries with higher financial markets index will have less biased reactions to earnings news.

3. Data Collection

For earnings surprise, we use earnings data from Bloomberg Terminal, which provides users with security data, analytics, and news. Due to limitations of data availability, this study selects 15 countries that have sufficient information on individual stock's historical earnings and prices. A complete list of countries can be found in Table 2. In each country, we choose the top 20 largest stocks based on their market capitalizations. To calculate individual stock's earnings surprise, we collect quarterly actual earnings, earnings estimates, and stock prices on earnings announcement day for each stock from Q1 2012 to Q4 2015. Earnings estimates are based on expectations of financial analysts from a variety of financial firms, which represent their understandings of individual companies and the entire stock market. Then, earnings surprise is measured by actual earnings minus earnings estimates scaled by stock price.

$$Earnings\ Surprise = \frac{Actual\ Earning - Earnings\ Estimates}{Stock\ Price}$$

Earnings surprise reflects how well earnings estimates incorporate past earnings news. If analysts understand historical news well, their estimates should be around companies' actual earnings and stock prices would not fluctuate significantly.

Levels of financial literacy for selected countries are from the Standard & Poor's Global Financial Literacy Survey in 2015, which have financial literacy level for each of the 15 countries. Financial markets indices are based on an IMF working paper, which constructs

indices from a variety of data sources and offers a thorough analysis for each country (Table 2).

Table 2. List of Selected Countries, Financial Literacy Levels, Financial Markets Index

Country	Financial Literacy	Financial Markets Index
Austria	0.53	0.654
Brazil	0.35	0.502
Canada	0.68	0.786
Chile	0.41	0.424
China	0.28	0.622
Germany	0.66	0.731
India	0.24	0.431
Indonesia	0.32	0.259
Japan	0.43	0.748
Mexico	0.32	0.341
Norway	0.71	0.764
Poland	0.42	0.344
Spain	0.49	0.836
Thailand	0.27	0.612
US	0.57	0.903

4. Treatment of Outliers

In most countries, values of earnings surprise oscillate around the mean and have a few outliers. Take Norway as an example. Earnings surprises for most observations are around 0.05%, while several observations have earnings surprise as high as 3.34%. To prevent outliers from masking the fitted regression line, mean and standard deviation of earnings surprise are calculated in each country across time, with ±3 standard deviations set at the cutoff levels. Any data that is above or below cutoff levels is eliminated from the sample.

5. Regression Analysis

After collecting all necessary data and calculating quarterly earnings surprises for all stocks, earnings surprise at quarter N is regressed on that at quarter N-1 in each country. Results of cross-sectional regressions are correlations between the magnitude of earnings surprise of two subsequent quarters. These coefficients measure how biased the reaction to past earnings surprise is, which are called "biasness" in the following sections. A positive biasness means that investors underreact to last period's surprise while a negative biasness indicates that investors overreact to past earnings changes. An efficient market should have a coefficient around 0, meaning that previous quarterly earnings news should have been incorporated by analysts into their expectations for this quarter's earnings. Therefore, quarter N's earnings surprise should be uncorrelated to that of quarter N-1. According to regression results, most countries have positive biasness, indicating that companies in those countries would have higher earnings surprises in later periods if their earnings surprises at this quarter are positive. Other countries, however, such as Brazil and Poland, have negative biasness, showing that stocks would continuously have negative earnings surprises for a few months if they have worse-than-expected earnings this quarter. Detailed results are shown in Table 3.

Since both positive and negative coefficients indicate inefficient market responses, absolute values of regression coefficients for each country are used as dependent variables. To assess the role that financial education plays in investors biased reactions, biasness is regressed on financial literacy levels of corresponding countries. Similar procedure is

applied to financial markets index, trying to identify its impacts on efficiency of stock markets.

Table 3. Results of Cross-sectional Regressions

Country	Biasness
Austria	0.23847
Brazil	-0.29440
Canada	0.20053
Chile	0.57167
China	0.18193
Germany	0.08013
India	0.08033
Indonesia	0.26740
Japan	0.17067
Mexico	0.19460
Norway	-0.00247
Poland	-0.64000
Spain	-0.24580
Thailand	0.08340
US	0.25307

Results and Conclusions

1. Financial Literacy

Biasness is regressed on levels of financial literacy of each country. Regression results are shown in Figure 2 and Table 4. The fitted linear regression line is:

$$\text{Biasness} = -0.173 * \text{Level of financial literacy} + 0.311.$$

The significance level of this model, however, is 57.9%. It is much higher than the common cutoff level of 5% or 10%, indicating that the financial literacy level is not a good predictor of how biased the reaction to past earnings news is. In other words, financial education does not play an important role in investors' decision-making process or in efficiency of financial markets. There is no evidence indicating that investors who are more financially literate would behave more rationally in stock markets.

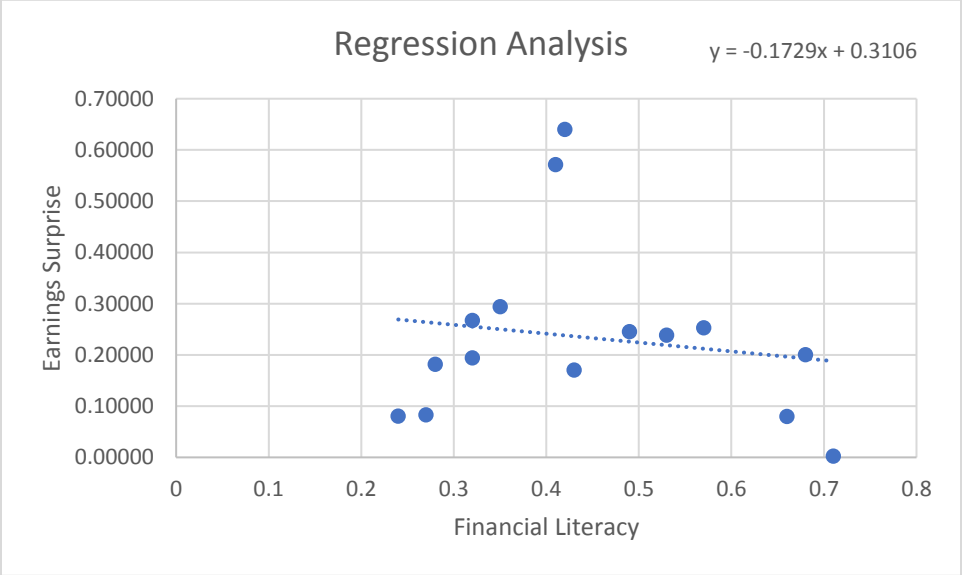
Table 4. Regression Result of Financial Literacy Levels

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	.311	.143		2.174	.049
	Financial Literacy	-.173	.304	-.156	-.569	.579

a. Dependent Variable: Earnings Surprise

Figure 2. Visualization of Fitted Linear Line for Financial Literacy



2. Financial Markets Index

Result of linear relationship between biasness and financial markets index is shown in Figure 3 and Table 5, which is consistent with Hypothesis 2. According to the result, the magnitude of biasness is negatively correlated to financial markets index. The fitted linear regression line is:

$$\text{Biasness} = -0.373 * \text{Financial markets index} + 0.456.$$

The significance level is 10.4%, which means that financial markets index is a marginally significant factor of this model. It indicates that more developed financial markets tend to be more efficient, and would incorporate information and past news more quickly.

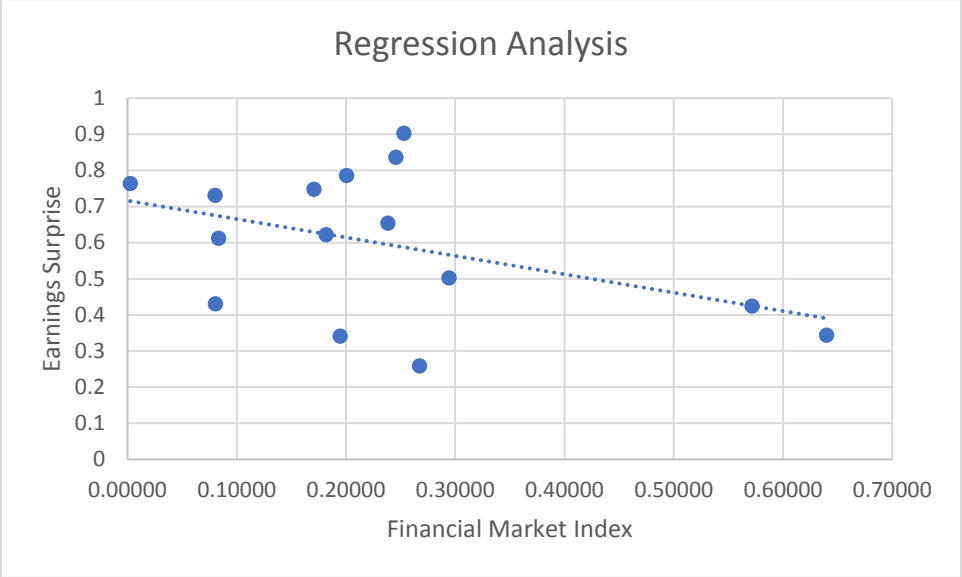
Table 5. Regression Result of Financial Markets Index

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	.456	.134		3.401	.005
	Index	-.373	.214	-.436	-1.746	.104

a. Dependent Variable: Earnings Surprise

Figure 3. Visualization of Fitted Linear Line for Financial Markets Index



Discussions

The result of linear regression between biasness and financial literacy levels indicates that financial education does not have any significant impact on underreactions or overreactions of stock prices to earnings announcements. The second regression model suggests that financial markets index could be used as a measurement of how rationally stock prices respond to earnings announcements and how well investors incorporate past news, which offers a way to compare market efficiency of different countries across the globe.

This study, however, has several limitations in terms of sample size and data collection. First of all, the sample size is small. This study selects 15 countries and then picks the top 20 largest stocks in each country based on their market capitalizations. Next, quarterly earnings surprises of 300 stocks from Q1 2012 to Q4 2015 are calculated. Relatively small sample size contains less information and increases uncertainties of estimates. Secondly, as this study only picks the top 20 largest stocks in each country, they may not represent the overall market movements. Thirdly, earnings estimates are based on expectations of financial analysts who have robust foundations in fundamentals of finance. Country's level of financial literacy, however, comes from randomly selected participants in that country, including students and employees from a variety of industries, and represents the entire national's financial abilities. The discrepancy of subjects between earnings estimates and levels of financial literacy would influence results of this study. Therefore, the regression of biasness on financial literacy levels may not be accurately enough to represent the relationship between financial education and investors' biased responses to earnings news in a country. Lastly, it is possible that financial literacy and financial markets index explain part of the price movements, but fail to capture all factors.

Further research can be conducted by extending the time span and including more countries and stocks. Large sample size could increase reliability of models and uncover accurate relationship between variables. Moreover, researchers could use small stocks in each country to estimate earnings surprise, which may result in stronger correlations. Furthermore, if there is available data, this study could use financial literacy levels of

analysts instead of that of the public to assess relations between financial education and biasness of stock prices.

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